

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1 Claim 1 (Currently amended): An acceleration
2 sensor for detecting an acceleration caused by an object
3 oscillated in an oscillation direction, comprising:
4 a sensor casing having a center axis and to be
5 positioned in coaxial alignment with said oscillation
6 direction to receive said acceleration, said sensor
7 casing having first and second circular inner surfaces
8 opposing to and spaced apart along said center axis from
9 each other at a first space distance less than 8.59mm,
10 and a third cylindrical inner surface connected at one
11 end with said first inner surface and at the other end
12 with said second inner surface to define a cylindrical
13 closed space;
14 an oscillation plate accommodated in said closed
15 space of said sensor casing and having a central portion
16 securely supported by said sensor casing and a peripheral
17 portion integrally formed with said central portion and
18 extending radially outwardly of said central portion to
19 be freely movable with respect to said sensor casing,
20 said oscillation plate having a peripheral end surface
21 spaced apart from said third inner surface of said sensor

22 casing at an annular gap small enough to enable said
23 oscillation plate to oscillate with respect to said
24 sensor casing, said oscillation plate having a first flat
25 surface opposing to and spaced apart along said center
26 axis from said first inner surface of said sensor casing
27 at a second space distance, and a second flat surface
28 opposing to and spaced apart along said center axis from
29 said second inner surface of said sensor casing at a
30 third space distance, said oscillation plate being partly
31 oscillatable along said center axis with respect to said
32 sensor casing; and

33 a piezoelectric element having first and second
34 surfaces and provided on at least one of said first and
35 second flat surfaces of said oscillation plate to
36 generate a voltage indicative of said acceleration when
37 said acceleration is exerted on said sensor casing to
38 have said oscillation plate partly oscillated along said
39 center axis with respect to said sensor casing with said
40 peripheral portion of said oscillation plate being
41 deformed; in which said ~~first~~ second space distance is
42 less than or equal to the diameter of said third inner
43 surface of said sensor casing multiplied by 0.1.

1 Claim 2 (Original): An acceleration sensor as set
2 forth in claim 1, in which said sensor casing has a

3 supporting portion projecting from said first inner
4 surface toward said second inner surface to support said
5 oscillation plate, said piezoelectric element being
6 provided on said second flat surface of said oscillation
7 plate and opposing to and spaced apart along said center
8 axis from said second inner surface of said sensor casing
9 at a fourth space distance, in which said second space
10 distance is less than or equal to the diameter of said
11 third inner surface of said sensor casing multiplied by
12 0.1, and in which said fourth space distance is less than
13 or equal to the diameter of said third inner surface of
14 said sensor casing multiplied by 0.1.

1 Claim 3 (Original): An acceleration sensor as set
2 forth in claim 1, in which said sensor casing has a
3 supporting portion projecting from said first inner
4 surface toward said second inner surface to support said
5 oscillation plate, said piezoelectric element being
6 provided on said first flat surface of said oscillation
7 plate and opposing to and spaced apart along said center
8 axis from said first inner surface of said sensor casing
9 at a fifth space distance, in which said third space
10 distance is less than or equal to the diameter of said
11 third inner surface of said sensor casing multiplied by
12 0.1, and in which said fifth space distance is less than

13 or equal to the diameter of said third inner surface of
14 said sensor casing multiplied by 0.1.

1 Claim 4 (Original): An acceleration sensor as set
2 forth in claim 1, in which said sensor casing has a
3 supporting portion projecting from said second inner
4 surface toward said first inner surface to support said
5 oscillation plate, said piezoelectric element being
6 provided on said first flat surface of said oscillation
7 plate and opposing to and spaced apart along said center
8 axis from said first inner surface of said sensor casing
9 at a sixth space distance, in which said third space
10 distance is less than or equal to the diameter of said
11 third inner surface of said sensor casing multiplied by
12 0.1, and in which said sixth space distance is less than
13 or equal to the diameter of said third inner surface of
14 said sensor casing multiplied by 0.1.

1 Claim 5 (Original): An acceleration sensor as set
2 forth in claim 1, in which said sensor casing has a
3 supporting portion projecting from said second inner
4 surface toward said first inner surface to support said
5 oscillation plate, said piezoelectric element being
6 provided on said second flat surface of said oscillation
7 plate and opposing to and spaced apart along said center

8 axis from said second inner surface of said sensor casing
9 at a seventh space distance, in which said second space
10 distance is less than or equal to the diameter of said
11 third inner surface of said sensor casing multiplied by
12 0.1, and in which said seventh space distance is less
13 than or equal to the diameter of said third inner surface
14 of said sensor casing multiplied by 0.1.

1 Claim 6 (Currently amended): An acceleration
2 sensor for detecting an acceleration caused by an object
3 oscillated in an oscillation direction, comprising:

4 a sensor casing having a center axis and to be
5 positioned in coaxial alignment with said oscillation
6 direction to receive said acceleration, said sensor
7 casing having first and second circular inner surfaces
8 opposing to and spaced apart along said center axis from
9 each other at a first space distance less than 8.59mm,
10 and a third cylindrical inner surface connected at one
11 end with said first inner surface and at the other end
12 with said second inner surface to define a cylindrical
13 closed space;

14 an oscillation plate accommodated in said closed
15 space of said sensor casing and having a central portion
16 securely supported by said sensor casing and a peripheral
17 portion integrally formed with said central portion and

18 extending radially outwardly of said central portion to
19 be freely movable with respect to said sensor casing,
20 said oscillation plate having a peripheral end surface
21 spaced apart from said third inner surface of said sensor
22 casing at an annular gap small enough to enable said
23 oscillation plate to oscillate with respect to said
24 sensor casing, said oscillation plate having a first flat
25 surface opposing to and spaced apart along said center
26 axis from said first inner surface of said sensor casing
27 at a second space distance, and a second flat surface
28 opposing to and spaced apart along said center axis from
29 said second inner surface of said sensor casing at a
30 third space distance, said oscillation plate being partly
31 oscillatable along said center axis with respect to said
32 sensor casing;

33 a first piezoelectric element having first and
34 second surfaces and provided on said first flat surface
35 of said oscillation plate to generate a voltage
36 indicative of said acceleration when said acceleration is
37 exerted on said sensor casing to have said oscillation
38 plate partly oscillated along said center axis with
39 respect to said sensor casing with said peripheral
40 portion of said oscillation plate being deformed; and

41 a second piezoelectric element having first and
42 second surfaces and provided on said second flat surface

43 of said oscillation plate to generate a voltage
44 indicative of said acceleration when said acceleration is
45 exerted on said sensor casing to have said oscillation
46 plate partly oscillated along said center axis with
47 respect to said sensor casing with said peripheral
48 portion of said oscillation plate being deformed; in
49 which said ~~first~~ second space distance is less than or
50 equal to the diameter of said third inner surface of said
51 sensor casing multiplied by 0.1.

1 Claim 7 (Original): An acceleration sensor as set
2 forth in claim 6, in which said sensor casing has a
3 supporting portion projecting from said first inner
4 surface toward said second inner surface to support said
5 oscillation plate, said first piezoelectric element being
6 provided on said first flat surface of said oscillation
7 plate and opposing to and spaced apart along said center
8 axis from said first inner surface of said sensor casing
9 at a fourth space distance, said second piezoelectric
10 element being provided on said second flat surface of
11 said oscillation plate and opposing to and spaced apart
12 along said center axis from said second inner surface of
13 said sensor casing at a fifth space distance, in which
14 said fourth space distance is less than or equal to the
15 diameter of said third inner surface of said sensor

16 casing multiplied by 0.1, and in which said fifth space
17 distance is less than or equal to the diameter of said
18 third inner surface of said sensor casing multiplied by
19 0.1.

1 Claim 8 (Original): An acceleration sensor as set
2 forth in claim 6, in which said sensor casing has a
3 supporting portion projecting from said second inner
4 surface toward said first inner surface to support said
5 oscillation plate, said first piezoelectric element being
6 provided on said first flat surface of said oscillation
7 plate and opposing to and spaced apart along said center
8 axis from said first inner surface of said sensor casing
9 at a sixth space distance, and said second piezoelectric
10 element being provided on said second flat surface of
11 said oscillation plate and opposing to and spaced apart
12 along said center axis from said second inner surface of
13 said sensor casing at a seventh space distance, in which
14 said sixth space distance is less than or equal to the
15 diameter of said third inner surface of said sensor
16 casing multiplied by 0.1, and in which said seventh space
17 distance is less than or equal to the diameter of said
18 third inner surface of said sensor casing multiplied by
19 0.1.

1 Claim 9 (Amended): An acceleration sensor for
2 detecting an acceleration caused by an object oscillated
3 in an oscillation direction, comprising:
4 a sensor casing having a center axis and to be
5 positioned in coaxial alignment with said oscillation
6 direction to receive said acceleration, said sensor
7 casing including a cylindrical fixed case member having a
8 circular bottom portion having a first circular inner
9 surface, a cylindrical side portion integrally formed
10 with said bottom portion, and a supporting portion
11 projecting from said bottom portion, and a cover member
12 being provided on said fixed case member and having a
13 circular cover portion having a second circular inner
14 surface, and a cylindrical side portion integrally formed
15 with said cover portion, said side portion of said fixed
16 case member having a third cylindrical inner surface
17 connected at one end with said first inner surface, said
18 side portion of said cover member having a fourth
19 cylindrical inner surface connected at one end with said
20 second inner surface, said second inner surface of said
21 cover portion of said cover member opposing to and spaced
22 apart along said center axis from said first inner
23 surface of said bottom portion of said fixed case member
24 at a first space distance less than 8.59mm, said first
25 inner surface of said bottom portion of said fixed case

26 member and said third inner surface of said side portion
27 of said fixed case member, and said second inner surface
28 of said cover portion of said cover member and said
29 fourth inner surface of said side portion of said cover
30 member collectively defining a cylindrical closed space;
31 an oscillation plate accommodated in said closed
32 space of said sensor casing and having a central portion
33 securely supported by said supporting portion of said
34 fixed case member of said sensor casing, and a peripheral
35 portion integrally formed with said central portion and
36 extending radially outwardly of said central portion to
37 be freely movable with respect to said sensor casing,
38 said oscillation plate having a peripheral end surface
39 spaced apart from said third inner surface of said side
40 portion of said fixed case member at an annular gap small
41 enough to enable said oscillation plate to oscillate with
42 respect to said sensor casing, said oscillation plate
43 having a first flat surface opposing to and spaced apart
44 along said center axis from said first inner surface of
45 said bottom portion of said fixed case member at a second
46 space distance, and a second flat surface opposing to and
47 spaced apart along said center axis from said second
48 inner surface of said cover portion of said cover member
49 at a third space distance, said oscillation plate being
50 partly oscillatable along said center axis with respect

51 to said sensor casing; and
52 a piezoelectric element having a first surface held
53 in contact with said second flat surface of said
54 oscillation plate, and a second surface opposing to and
55 spaced apart along said center axis from said second
56 inner surface of said cover portion of said cover member
57 at a fourth space distance, said piezoelectric element
58 being provided on said second flat surface of said
59 oscillation plate in axial alignment with said
60 oscillation plate to generate a voltage indicative of
61 said acceleration when said acceleration is exerted on
62 said sensor casing to have said oscillation plate partly
63 oscillated along said center axis with respect to said
64 sensor casing with said peripheral portion of said
65 oscillation plate being deformed; in which said first
66 space distance is less than or equal to the diameter of
67 said third inner surface of said side portion of said
68 fixed case member multiplied by 0.1, and in which said
69 ~~first~~ second space distance is less than or equal to the
70 diameter of said fourth inner surface of said side
71 portion of said cover member multiplied by 0.1.

1 Claim 10 (Original): An acceleration sensor as set
2 forth in claim 9, in which said second space distance is
3 less than or equal to the diameter of said third inner

4 surface of said side portion of said fixed case member
5 multiplied by 0.1, and in which said fourth space
6 distance is less than or equal to the diameter of said
7 third inner surface of said side portion of said fixed
8 case member multiplied by 0.1.

1 Claim 11 (Original): An acceleration sensor as set
2 forth in claim 9, in which said second space distance is
3 less than or equal to the diameter of said fourth inner
4 surface of said side portion of said cover member
5 multiplied by 0.1, and in which said fourth space
6 distance is less than or equal to the diameter of said
7 fourth inner surface of said side portion of said cover
8 member multiplied by 0.1.

1 Claim 12 (Original): An acceleration sensor as set
2 forth in claim 9, in which said piezoelectric element is
3 in the form of an annular shape and has said first
4 surface held in contact with said second flat surface of
5 said oscillation plate and having thereon a first
6 electrode between said first surface of said
7 piezoelectric element and said second flat surface of
8 said oscillation plate, and said second surface opposing
9 to said second inner surface of said cover portion of
10 said cover member and having thereon a second electrode

11 opposing to said second inner surface of said cover
12 portion of said cover member, and in which said first and
13 second electrodes enable said voltage indicative of said
14 acceleration to output therethrough.

1 Claim 13 (Original): An acceleration sensor as set
2 forth in claim 9, in which said fixed case member is made
3 of a metal, and said cover member is made of a plastic.

1 Claim 14 (Original): An acceleration sensor as set
2 forth in claim 9, in which said side portion of said
3 fixed case member has a first section close to said
4 bottom portion of said fixed case member, a second
5 section remote from said bottom portion of said fixed
6 case member, and an annular ledge section formed between
7 said first and second sections with an annular groove
8 open toward said side portion of said cover member, in
9 which the diameter of said first section of said side
10 portion of said fixed case member is smaller than or
11 equal to the diameter of said side portion of said cover
12 member, and in which said side portion of said cover
13 member is snugly received in said annular groove with a
14 resilient ring intervening between said annular ledge
15 section of said side portion of said fixed case member
16 and said side portion of said cover member to

17 hermetically seal the gap between said annular ledge
18 section of said side portion of said fixed case member
19 and said side portion of said cover member.

1 Claim 15 (Original): An acceleration sensor as set
2 forth in claim 9, which further comprises an output
3 terminal pin mounted on said cover member and extending
4 into said closed space to be electrically connected to
5 said piezoelectric element, in which said output terminal
6 pin has a terminal end portion projecting outwardly of
7 said cover member and electrically connectable with an
8 exterior coupling member to output said voltage
9 indicative of said acceleration.

1 Claim 16 (Original): An acceleration sensor as set
2 forth in claim 9, in which said fixed case member has a
3 screw portion to be screwed to said object which is to
4 receive said acceleration.

1 Claim 17 (Original): An acceleration sensor as set
2 forth in claim 9, in which said supporting portion of
3 said fixed case member projects toward said cover portion
4 of said cover member and is tapered toward said
5 oscillation plate.

1 Claim 18 (Currently amended): An acceleration
2 sensor for detecting an acceleration caused by an object
3 oscillated in an oscillation direction, comprising:
4 a sensor casing having a center axis and to be
5 positioned in coaxial alignment with said oscillation
6 direction to receive said acceleration, said sensor
7 casing including a cylindrical fixed case member having a
8 circular bottom portion having a first circular inner
9 surface, and a cylindrical side portion integrally formed
10 with said bottom portion, said side portion of said fixed
11 case member having a first section close to said bottom
12 portion of said fixed case member, a second section
13 remote from said bottom portion of said fixed case member
14 and radially inwardly bent, and an annular ledge section
15 formed between said first and second sections with an
16 annular ledge, a metal base member having a circular base
17 portion and a supporting portion, said base portion
18 having a second circular inner surface and a circular
19 outer surface, and said supporting portion projecting
20 from said second inner surface, said base portion of said
21 metal base member having a central section integrally
22 formed with said supporting portion, and a peripheral
23 section extending radially outwardly of said central
24 section, said metal base member mounted on said annular
25 ledge of said fixed case member with a resilient ring

26 intervening between said second section of said side
27 portion of said fixed case member and said peripheral
28 section of said base portion of said metal base member to
29 hermetically seal the gap between said second section of
30 said side portion of said fixed case member and said
31 peripheral section of said base portion of said metal
32 base member, said first section of said side portion of
33 said fixed case member having a third cylindrical inner
34 surface connected at one end with said first inner
35 surface of said bottom portion of said fixed case member
36 and at the other end with said second inner surface of
37 said base portion of said metal base member, said second
38 inner surface of said base portion of said metal base
39 member opposing to and spaced apart along said center
40 axis from said first inner surface of said bottom portion
41 of said fixed case member at a first space distance less
42 than 8.59mm, and a cover member being provided on said
43 outer surface of said metal base member and having a
44 peripheral section firmly engaged with said second
45 section of said side portion of said fixed case member,
46 said first inner surface of said bottom portion of said
47 fixed case member, said second inner surface of said base
48 portion of said metal base member, and said third inner
49 surface of said first section of said side portion of

said fixed case member collectively defining a
cylindrical closed space;

an oscillation plate accommodated in said closed space
of said sensor casing and having a central portion securely
supported by said supporting portion of said metal base
member of said sensor casing, and a peripheral portion
integrally formed with said central portion and extending
radially outwardly of said central portion to be freely
movable with respect to said sensor casing, said
oscillation plate having a peripheral end surface spaced
apart from said third inner surface of said first section
of said side portion of said fixed case member at an
annular gap small enough to enable said oscillation plate
to oscillate with respect to said sensor casing, said
oscillation plate having a first flat surface opposing to
and spaced apart along said center axis from said first
inner surface of said bottom portion of said fixed case
member at a second space distance, and a second flat
surface opposing to and spaced apart along said center axis
from said second inner surface of said base portion of said
metal base member at a third space distance, said
oscillation plate being partly oscillatable along said
center axis with respect to said sensor casing; and

a piezoelectric element having a first surface
opposing to and spaced apart along said center axis from

75 said first inner surface of said bottom portion of said
76 fixed case member at a fourth space distance, and a
77 second surface held in contact with said first flat
78 surface of said oscillation plate, said piezoelectric
79 element being provided on said first flat surface of said
80 oscillation plate in axial alignment with said
81 oscillation plate to generate a voltage indicative of
82 said acceleration when said acceleration is exerted on
83 said sensor casing to have said oscillation plate partly
84 oscillated along said center axis with respect to said
85 sensor casing with said peripheral portion of said
86 oscillation plate being deformed; in which said ~~first~~
87 second space distance is less than or equal to the
88 diameter of said third inner surface of said first
89 section of said side portion of said fixed case member
90 multiplied by 0.1.

1 Claim 19 (Original): An acceleration sensor as set
2 forth in claim 18, in which said third space distance is
3 less than or equal to the diameter of said third inner
4 surface of said first section of said side portion of
5 said fixed case member multiplied by 0.1, and in which
6 said fourth space distance is less than or equal to the
7 diameter of said third inner surface of said first

8 section of said side portion of said fixed case member
9 multiplied by 0.1.

1 Claim 20 (Original): An acceleration sensor as set
2 forth in claim 18, in which said piezoelectric element is
3 in the form of an annular shape and has said first
4 surface opposing to said first inner surface of said
5 bottom portion of said fixed case member and having
6 thereon a first electrode opposing to said first inner
7 surface of said bottom portion of said fixed case member,
8 and said second surface held in contact with said first
9 flat surface of said oscillation plate and having thereon
10 a second electrode between said second surface of said
11 piezoelectric element and said first flat surface of said
12 oscillation plate, in which said first and second
13 electrodes enable said voltage indicative of said
14 acceleration to output therethrough.

1 Claim 21 (Original): An acceleration sensor as set
2 forth in claim 18, in which said fixed case member and
3 said metal base member are made of a metal, and said
4 cover member is made of a plastic.

1 Claim 22 (Original): An acceleration sensor as set
2 forth in claim 18, which further comprises an output

3 terminal pin mounted on said cover member and partly
4 extending through said cover member, said supporting
5 portion of said metal base member, said oscillation
6 plate, and said piezoelectric element into said closed
7 space to be electrically connected to said piezoelectric
8 element, in which said output terminal pin has a terminal
9 end portion projecting outwardly of said cover member and
10 electrically connectable with an exterior coupling member
11 to output said voltage indicative of said acceleration.

1 Claim 23 (Original): An acceleration sensor as set
2 forth in claim 18, in which said fixed case member has a
3 screw portion to be screwed to said object which is to
4 receive said acceleration.

1 Claim 24 (Original): An acceleration sensor as set
2 forth in claim 18, in which said supporting portion of
3 said metal base member projects toward said bottom
4 portion of said fixed case member and is tapered toward
5 said oscillation plate and formed with a through bore.

1 Claim 25 (Original): An acceleration sensor as set
2 forth in claim 18, which further comprises a resilient
3 metal plate in the form of a truncated cone shape and

4 having an open end electrically connectable with said
5 piezoelectric element.

1 Claim 26 (Original): An acceleration sensor as set
2 forth in claim 25, in which said bottom portion of said
3 fixed case member is formed with a central cavity plate
4 open toward said metal plate and in the form similar to
5 said shape of said metal plate.

1 Claim 27 (Original): An acceleration sensor as set
2 forth in claim 18, in which said oscillation plate has a
3 central hole formed at the center portion thereof and
4 open at said first and second flat surfaces, in which
5 said piezoelectric element has a central hole formed at
6 the center portion thereof and open at its first and
7 second surfaces.

Claims 28-48 (Canceled)